



Technical Research Study

 PROWESS

Five Ways Content Delivery Network (CDN) Providers Can Meet the Challenges of a Rapidly Changing Business Landscape

CDNs can meet market needs by augmenting their engineering, logistics, and supply chain capabilities with solutions from Dell Technologies OEM Solutions and AMD.

 Dell Technologies

 AMD

Executive Summary

Content delivery network (CDN) providers, including companies designing their own CDN solutions, face a rapidly changing business landscape. With the move to remote work and rising demand for 4K and 8K media content, traffic over CDNs is up sharply. At the same time, opportunities to offer new services like immersive gaming and live events beckon—and at global scale. But challenges abound. Today, CDNs are competing not only on technical offerings but on the ability to offer compelling business models and comprehensive support services.

Prowess Consulting research identified five focus areas that CDN providers should pursue to succeed in today’s environment. These include improving scalability, minimizing network latency, increasing cost effectiveness and energy efficiency to lower total cost of ownership (TCO), enhancing resiliency and reliability, and prioritizing security.

This research study outlines how a CDN provider can prioritize these focus areas using solutions and resources from Dell Technologies OEM Solutions and AMD. Dell Technologies OEM Solutions offers design and engineering capabilities, customization, tailored service offerings, and global logistics and supply chain resources that help CDN providers design solutions based on industry-leading infrastructure such as Dell PowerEdge servers and deploy them globally with robust customer support. AMD® processors power solutions that help ensure that servers comprising a CDN manage peak traffic demands, offer high availability, and expand geographic reach while offering robust security features and greater value.

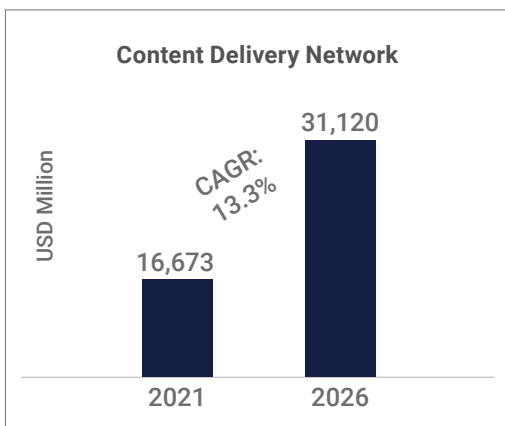


Figure 1. Total addressable CDN market between 2021 and 2026²

Industry Landscape

CDN providers face a rapidly changing business landscape with incredible opportunities for those willing and able to move quickly. In the past two years, most CDN providers have doubled their peak traffic capacity on average (as measured in terabits per second) to address increasing content demand coinciding with increased remote work and on-demand video consumption during the pandemic.¹

Markets for online gaming, video streaming, and ecommerce are expanding globally.¹ And services beyond traditional media delivery and web hosting, including 4K and 8K media content delivery, immersive gaming, security, interactive live streaming, and media sharing, beckon with higher margins.¹

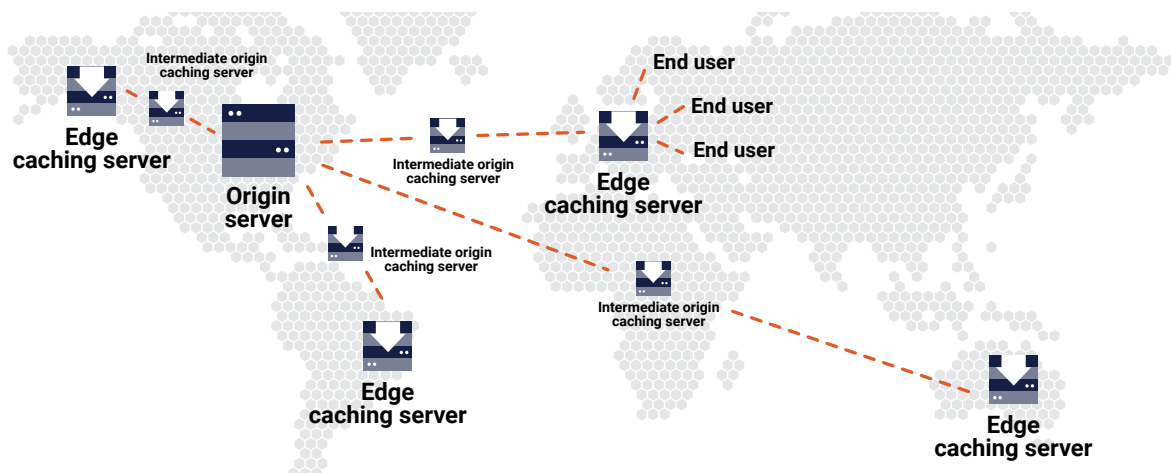


Figure 2. A CDN is a geographically distributed group of servers that work together to provide fast delivery of media, web pages, online gaming, and other content

CDN providers typically design CDNs using a hub-and-spoke model, which achieves multiple goals:

1. Makes it easy to manage content and digital rights management
2. Places content closer to consumers
3. Provides the ability to scale

The hub, or origin server, distributes content. An origin server might be a Dell PowerEdge server with an AMD EPYC™ processor and fast NVM Express® (NVMe®) storage, for example. It is deployed in data centers whose central locations—often in urban areas—provide access to multiple high-bandwidth carrier networks. An origin server pushes content to either an intermediate origin server or an edge caching server. Edge caching servers reside in data centers close to consumers.

When a content consumer requests an episode of their favorite TV show or engages colleagues on a chat-based collaboration program, the CDN validates the user rights and then determines the shortest path from an available edge caching server to the consumer's device. The network then streams content and varies the resolution or bitrate depending on the device's screen size and bandwidth.

Five Focus Areas for CDNs

To succeed in today's dynamic business environment, Prowess Consulting recommends five areas of focus for CDN providers to stay on track for business success. These include:

Scalability: handle high traffic loads as needed

Network responsiveness: minimize latency

Lowering TCO: increase cost-effectiveness and engineering efficiency

Ensuring resiliency and high reliability: meet customer SLAs

Securing networks: help prevent cyberattacks

Dell Technologies OEM Solutions with AMD for CDN Providers

We used Dell Technologies OEM Solutions and AMD to illustrate how a CDN provider can address top focus areas. Dell Technologies OEM Solutions offers a broad portfolio of platforms and solutions, in addition to unique capabilities such as design, engineering, customization and system optimization, program management, and more. Dell Technologies can help CDN providers and solution builders design solutions that take advantage of technologies like virtualization, DevOps, and peer-to-peer (P2P) with exceptional scaling, latency, resilience, security, and efficiency. Additionally, Dell Technologies OEM Solutions offers global delivery and support, along with an industry-leading secure supply chain.

Dell Technologies partners with dynamic and agile companies like AMD to drive business transformation for its customers. Together, Dell Technologies OEM Solutions and AMD work to continually enhance CDNs.

Customers benefit from Dell servers running compute-dense AMD processors with high core counts, in addition to broad memory bandwidth and efficiency. AMD EPYC processors are the world's highest performance x86 server processors.³ Additionally, the AMD portfolio is now complemented by Xilinx® Adaptive Computing solutions.

Dell Technologies OEM Solutions Is the #1 OEM Solutions Provider Worldwide⁴

Dell Technologies OEM Solutions has a history of more than 20 years of helping solution builders and product-development organizations design solutions across 40+ verticals, including media and entertainment (M&E).⁵ Dell Technologies OEM Solutions has worked with more than 4,000 customers and 500 partners in 70 countries worldwide.

Dell Technologies and AMD work together to help CDN providers build their solutions and configure products such as Dell PowerEdge servers with fast AMD processors offering robust security capabilities. Dell Technologies OEM Solutions features a broad portfolio: standard Dell-branded products and unique off-the-shelf OEM offerings including de-branded products and rebrand-ready products (these are products to which a customer can add its logo). And when standard offerings aren't the right fit, Dell Technologies OEM Solutions engineering and product teams can design a customized solution. This gives CDN providers the flexibility to deploy industry-leading infrastructure based on the right server configuration in the right location at the right time, supported by world-class services.

Server configurations might include:

- Custom commodity injections including drives, network interface controllers (NICs), graphics processing units (GPUs), data processing units (DPUs), and field-programmable gate arrays (FPGAs)
- Custom RAID configurations
- Proprietary application workloads

Servers can be built up in the factory or at a second-touch integration site. Now let's dig into the five focus areas that Prowess recommends.

1. Scale to Handle High Volumes of Traffic

Consumers have come to expect a flawless, engaging content experience. This includes during live events like watch parties, after software releases, and during the launch of online games. And when content demand spikes, scalability becomes critical.

To be ready for traffic spikes, CDN providers must have sufficient networking and processing resources. They must give special attention to the computing and caching resources of cache servers. A typical cache server design includes large amounts of RAM and high CPU throughput along with high-capacity solid-state drives (SSDs). RAM and SSDs provide high-speed access to cached objects—images, video, or web pages. RAM—being the faster of the two—is used to store the most popular content or frequently-accessed items.

Dell Technologies OEM Solutions and AMD can help CDN providers design for high-traffic scenarios. Dell Technologies OEM Solutions offers design services and can create custom server configurations with high-performance networking, memory, or storage. Additionally, Dell Technologies offers a global supply chain and excellent product support to deploy and maintain servers.

AMD EPYC processors are a compelling computing resource to scale CDN traffic effectively: they offer high core counts, large memory capacity, ample memory bandwidth, and massive input/output (I/O) in the right ratios to deliver required caching performance. The AMD EPYC 7003 Series processors, for example, scale from 8 to 64 cores (or 16 to 128 threads per socket).⁶ No other x86 server processors offer this level of core density. With the introduction of AMD 3D V-Cache™, solutions can reach new heights with true 3D die stacking, delivering 3x the L3 cache for breakthrough per-core performance.⁷

Dell Technologies OEM Solutions and AMD can help CDN providers manage high-volume content spikes by:

- Matching core count and core density with content-delivery application needs
- Taking advantage of AMD EPYC processors' plentiful I/O and high memory bandwidth
- Installing custom high-performance memory or storage components
- Programming custom BIOS settings and installing custom operating system (OS) images

CDN Provider Benefits from Customization⁸

A CDN solution provider had an established core competency of software including valuable intellectual property (IP). The company teamed with Dell Technologies and AMD for its hardware infrastructure. Dell Technologies configured servers with custom BIOS settings and integrated non-standard hardware at the factory, such as highly specific SSDs and GPUs. Dell Technologies OEM Solutions included global support and a basic warranty for the non-standard cards so that the provider was covered in the event of hardware failure anywhere in the world. With Dell Technologies and AMD, the CDN solution provider was able to offer a differentiated product out of the factory without the need for additional handling.

2. Minimize Latency

Low latency is a key value proposition for CDN providers. When an ecommerce web page loads even 100 milliseconds slower, research demonstrates that the site's sales can drop up to 7 percent.⁹ Keeping latency low can become more difficult with increasing volumes of data. From 2000 to 2022, the usage of the internet increased by 1,355 percent, with streaming video being a key driver.^{10,11} Prowess recommends low latency as a second focus area.

To minimize latency, CDN providers can deploy high-performance cache servers closer to the consumer. Providers can also build out data centers (sometimes called points-of-presence, or PoPs), ideally at major networking hubs for optimal connectivity. A provider can also arrange peering agreements with other CDN providers and major carriers.

Dell Technologies OEM Solutions helps CDN providers meet latency challenges with Dell Modular Data Centers. These are prefabricated data centers that allow IT systems to be deployed outside of the traditional data center. This pushes the edge compute/cache out further, closer to the end user.¹²

IDC forecasts the compound annual growth rate (CAGR) growth of edge CDNs at 41.9 percent through 2025.¹³ However, standard technology is not designed to work in the type of environments found at the edge. Dell Technologies offers edge-optimized infrastructure to help providers succeed in these new environments.

AMD processors can contribute to lower latency through leadership I/O bandwidth. AMD EPYC processors offer 8 x 16 links of PCIe[®] Gen4 with 128 PCIe 4.0 lanes in a single socket or up 160 PCIe 4.0 lanes in a dual-socket implementation.¹⁴

Customer Chooses Dell Technologies and AMD Based on Performance, Reliability, and Quality⁸

Dell Technologies OEM Solutions and AMD gained a new customer by co-engineering a solution customizing Dell PowerEdge 6500 and 7500 series servers. The superior performance of AMD EPYC™ processors, along with PCIe[®] 4.0 and NVMe[®] support, helped influence the decision. Additionally, Dell Technologies OEM Solutions' global footprint, along with the quality and reliability of its servers, also factored into the customer's decision.

3. Lower Costs, Increase Efficiency

To lower TCO, Prowess Consulting recommends that CDN providers focus on cost-effective and energy-efficient solutions. With downward pressure on budgets and an increased focus on sustainability, CDN providers should look for ways to efficiently support higher video-stream densities and more dynamic content. There are several ways that Dell Technologies OEM Solutions and AMD can help. These include:

- Increasing efficiency with a smaller data center footprint, lower power and cooling costs, and lower network costs
- Moving to processors with higher core densities, more I/O capabilities, and lower thermal design power (TDP)
- Employing single-socket servers with simpler software architectures
- Making use of Dell Technologies OEM Solutions' design, engineering, program management, supply chain, and services capabilities, in addition to gaining access to its extensive partner ecosystem

Dell Technologies OEM Solutions can create custom server configurations with a balance between performance and cost for a given CDN server function. This might mean removing some of the drives or splitting PCIe slots across CPUs. It could also mean balancing storage and network I/O between different CPUs.

AMD EPYC processors—CPUs with high core densities, massive I/O capabilities, and low TDP—can help CDN providers do more with less. For example, using a single-socket solution can greatly reduce the impact of NUMA boundaries. This enables more efficient configurations from the perspective of both performance and cost. AMD processor-powered platforms can also meet application

performance demands with fewer physical servers—which can lead to a smaller data center footprint, lower power and cooling costs, lower network costs, and lower total cost of ownership (TCO). Additionally, by using PCIe Gen4 and 100 gigabit Ethernet (GbE), CDN providers gain a good balance between memory and CPU.

AMD Performance Helps Lower Total Cost

AMD helped a CDN move from a dual-socket server from another vendor to a single-socket Dell server. The performance of the server was the same or better with the AMD® processor, while the total cost was lower because only a single-socket was required.¹⁵

4. Ensure Resiliency and High Reliability

Consumers expect 100 percent uptime when consuming content. They don't want their favorite content to freeze at the wrong time. Because of this, Prowess recommends resiliency and reliability as a fourth focus for CDN providers.

To achieve resiliency, providers can start with a foundation of reliable servers and then build in load balancing and intelligent failover capabilities. Dell servers have a reputation for reliability—third parties call Dell servers the most dependable on the market.¹⁶ AMD reports that its processors are widely deployed in CDNs under heavy production loads with the very largest of streaming customers.⁸

For load balancing, Dell Technologies OEM Solutions can assist with design services. The goal is to route traffic from a load-balancing functional service to one of many servers. Then, during high traffic, the load balancer will evenly distribute traffic across multiple servers to help prevent an individual server from crashing under a load of more traffic than it can handle.

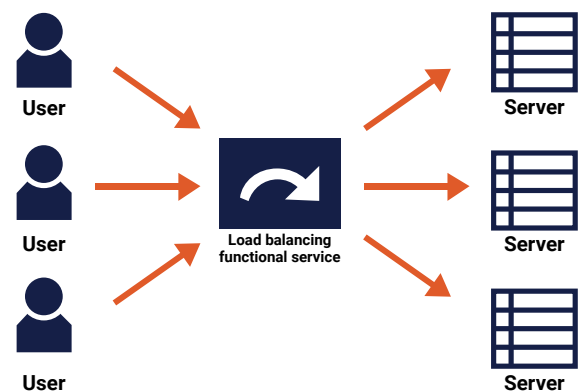


Figure 4. The load-balancing function service will evenly distribute traffic across multiple servers

Dell Technologies and AMD Help Providers Balance Configurations to Optimize Costs at Scale⁸

Even savings of a few dollars makes a difference when many servers are deployed at scale. Dell Technologies and AMD worked with a CDN provider to balance I/O across multiple CPUs to maximize performance and minimize costs. They optimized storage and networking. The number of network ports was matched to CPUs, and the throughput of those ports, along with that of the storage drives, was optimized. Data traveled in and out of the server as quickly as possible.

5. Secure Networks

More CDN traffic increases exposure to security risks. CDNs rely on browsers for some content delivery, and browsers are enticing targets for Secure Sockets Layer (SSL)-based distributed denial of service (DDoS) attacks, direct IP attacks, and dynamic-content attacks. In July 2022, the CDN provider Cloudflare reported that within a few weeks, the Mantis botnet had launched more than 3,000 HTTP-based DDoS attacks that affected more than 1,000 customers.¹⁷ With these risks, Prowess recommends that security be a fifth focus of CDN providers.

To assist CDN providers with security, Dell Technologies OEM Solutions and AMD EPYC processors provide hardware-based, multi-layered security that works under the OS and application layers, which helps prevent malware from taking root in OS, firmware, and applications.¹⁸

AMD EPYC processors include AMD® Infinity Guard, a suite of security technologies built right in the chip. The “root of trust” validates the BIOS using a hardened security checkpoint to help prevent software from being corrupted during startup. Full memory encryption protects data from certain cold boot attacks, even if the memory is physically removed from the server.¹⁹

Additionally, the Dell Technologies supply chain assurance program implements safeguards that enable zero trust across the physical, personnel, and cybersecurity realms to help ensure a resilient manufacturing and delivery process.

Focus Areas Increase CDN Success

Prowess Consulting research identified five areas that CDN providers should focus on to increase their chances of success in today's changing M&E landscape. These include prioritizing the following activities:

- Improving scalability
- Minimizing latency
- Increasing cost effectiveness and energy efficiency
- Ensuring resiliency and high reliability
- Securing networks

This research report illustrates how CDN providers can take advantage of the unique capabilities of Dell Technologies OEM Solutions. These include design, engineering, program management, tailored services, a world-class secure supply chain, and an innovative portfolio of products and solutions, such as Dell PowerEdge servers built with AMD processors.

To learn more about how Dell Technologies OEM Solutions can help CDN providers achieve business success, visit Dell Technologies OEM Solutions at [Dell.com/OEM](https://www.dell.com/oem).



- ¹ Imperva. "What is a CDN?" www.imperva.com/learn/performance/what-is-cdn-how-it-works/.
- ² According to MarketsandMarkets' report on the content delivery network market published in March 2022. MarketsandMarkets "Content Delivery Network Market" March 2022. www.marketsandmarkets.com/Market-Reports/content-delivery-networks-cdn-market-657.html.
- ³ AMD. AMD EPYC product page. www.amd.com/en/products/epyc-server.
- ⁴ Global Share based on 2021 Revenue, VDC Research, Worldwide OEM Solutions Provider.
- ⁵ Dell Technologies. "Design your breakthrough for the intelligent edge." www.delltechnologies.com/asset/en-us/solutions/oem-solutions/briefs-summaries/dell-oem-one-pager.pdf.
- ⁶ AMD. "AMD EPYC™ 7003 Series Processors." www.amd.com/en/processors/epyc-7003-series.
- ⁷ MLNX-012: AMD EPYC™ 7003 Processors with AMD 3D V-Cache™ have 768 MB of L3 Cache, while AMD EPYC 7003 processors without 3D V-Cache have 256 MB.
- ⁸ This scenario was shared with Prowess Consulting in an interview with Dell Technologies OEM Solutions and AMD.
- ⁹ GlobalDots. "Content Delivery Network Explained." April 2021. www.globaldots.com/resources/blog/content-delivery-network-explained/.
- ¹⁰ Broadband Search. "Key Internet Statistics to Know in 2022 (Including Mobile)." www.broadbandsearch.net/blog/internet-statistics.
- ¹¹ Deloitte. "Coming to a CDN near you: Videos, games, and much, much more." December 2019. <https://www2.deloitte.com/us/en/insights/industry/technology/technology-media-and-telecom-predictions/2020/content-delivery-networks-video-streaming.html>.
- ¹² Light Reading. "The impact of the ever-shifting edge." July 2021. www.lightreading.com/the-edge/the-impact-of-ever-shifting-edge/a/d-id/770942.
- ¹³ Fastly. "IDC MarketScape: Worldwide Commercial Content Delivery Network Services 2022." 2022. <https://learn.fastly.com/delivery-IDC-Marketscape-CDN>.
- ¹⁴ AMD. AMD Infinity Architecture webpage. www.amd.com/en/technologies/infinity-architecture.
- ¹⁵ Prowess interview with Dell Technologies and AMD. August 31, 2022.
- ¹⁶ Server Basket. www.serverbasket.com/help/dell-servers-vs-hp-servers-comparison/.
- ¹⁷ ZDNet. "This tiny botnet is launching the most powerful DDoS attacks yet." July 2022. www.zdnet.com/article/this-tiny-botnet-is-launching-the-most-powerful-ddos-attacks-yet/.
- ¹⁸ AMD. "Helping Secure the Cloud with AMD EPYC™ Secure Encrypted Virtualization." April 2019. <https://developer.amd.com/wp-content/resources/HelpingSecuretheCloudwithAMDEPYCSEV.pdf>.
- ¹⁹ AMD. "5 Reasons Why AMD Infinity Guard Matters for Security." 2022. www.amd.com/system/files/documents/amd-5-reasons-why-security.pdf.



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